TITLE: COMBINATION OF ROFA AND ROTAMIX IN UNIT 6 AT THE CAPE FEAR STATION

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SUMMARY

Mixing of combustion gases inside the furnace is of great importance to achieve optimum combustion. A good intermixing is also essential to achieve high efficiency of the use of any chemical in the furnace. This new intermixing system developed by Mobotec comprises of the following steps:

1. ROFA (Rotating Opposed Fire Air). This is an improved over fire air system that assures good intermixing throughout the entire furnace volume. This results in a more efficient combustion process with lower NOx, lower CO, improved boiler efficiency and better control of unburned carbon.
2. ROTAMIX (ROTAting MIXing). This is a second generation SNCR. The good intermixing created by ROFA enhances the SNCR process or the use of any other chemical injection in the furnace. The chemicals are injected through the ROFA air nozzles and good mixing takes place with the combustion gases in the entire furnace.

The Mobotec system (ROFA+ROTAMIX) has been proven in more than 18 plants using different kinds of fuel.

Cape Fear Power Station, in Moncure, North Carolina, is owned and operated by Carolina Power & Light (Progress Energy) and consists of two units. Unit 5 is a 150MW tangential coal fired unit and Unit 6 is a 175MW tangential coal fired unit with a twin furnace. Both boilers were manufactured by Combustion Engineering.

Mobotec installed the ROFA system on Unit 5 last year and it went in operation in July of 2000. Later that year we received the award to proceed with the Engineering and Procurement for the installation of ROFA/ROTAMIX on Unit 6 to be installed during the spring 2001 outage.

The first order of business was to conduct computer simulations of the furnace of Unit 6. The furnace is a tangentially fired twin furnace with a total of 40 burners, each half having 20 burners arranged in five vertical rows. The main fuel is pulverized coal and the

CFD model was studied at a net load of 173Mwe corresponding to a firing rate of 475MWt.
The study consisted of a baseline case, which is the existing furnace configuration, and a number of ROFA cases. The ROFA cases have the same total mass flow of air and inlet temperature as the baseline case, the only difference is that some of the secondary air is redistributed to the ROFA system which injects this air at different levels between the burners and the nose of the furnace.
The optimum CFD results are used to determine the configuration of the ROFA system and the installation of the ROFA nozzles.

ROFA prepares the way for the effective mixing of chemicals in the furnace, because of a more homogenous furnace temperature. The reducing chemicals can then be injected into the furnace where the temperature is more favorable for NOx reduction. The result is considerably reduced chemical consumption and lower ammonia slip.

All CFD models assume equal flow of fuel and primary air to each burner. One additional case was included in this study, that of non-symmetric mass flow imbalances in coal and primary air. The imbalances were based on actual measurements carried out on Unit 6 at Cape Fear.

The overall results show that the ROFA would lead to improved mixing of combustion products, reduced NOx production and reduced LOI, relative to the baseline conditions that were simulated. The case with the imbalances in fuel and primary air showed slightly higher levels of NOx and LOI at the furnace exit, but still considerably below the baseline case.

In summary, the simulations indicate the following:

- Reduced temperature variation in the cross section of the upper furnace
- A more even distribution of combustion products in the cross section of the upper furnace
- Significantly lower exit NOx
- Lower exit LOI due to improved mixing
- More effective use of SNCR because of the better mixing in the furnace

Some of the CFD outputs are shown in the Appendix.

The unit should be operational with ROFA/ROTAMIX in June of this year and will corroborate the data from the CFD.